2

WATER SUPPLY AND MANAGEMENT

The Bear River's average annual inflow to the Great Salt Lake is nearly 1.2 million acre-feet (1941-1990). Some of this water can be developed to meet future needs within the basin, as well as some needs outside the basin in Salt Lake, Davis and Weber counties.

CLIMATE, PRECIPITATION AND EVAPORATION

The Bear River Basin is typical of mountainous areas in the West, with wide variations in temperature between summer and winter and between day and night. The high mountain valleys experience long, cold winters and short, cool summers. The lower valleys are warmer, but have more variance between maximum and minimum temperatures. As elevations in the basin vary from 4,200 to 13,000 feet, precipitation also varies from 10 to 65 inches. Figure 2 shows a detailed picture of the basin's average annual precipitation. Precipitation in the lower basin during the May-September growing season is only 5 to 6 inches, compared to a crop water requirement of 20 to 30 inches.

The National Weather Service has 18 climatological stations located throughout the Utah portion of the basin. These have varying lengths of record. Data from these stations are listed in Table 1. Mean annual temperatures vary from a high of 52.9^{o} F in Tremonton to a low of 37.0^{o} F at the Uintalands Weather Station. The record high temperature for the basin was 110^{o} F in Corinne, and the record low was -47^{o} F in Woodruff. Precipitation results primarily from two major storm patterns: (1) frontal systems from the Pacific Northwest during winter and spring; and (2) thunderstorms from the south and southwest in the late summer and early fall. These storm patterns are influenced by the topography of the basin. As storm clouds rise over mountains, the amount of precipitation increases significantly with elevation. The difference in elevation between valleys and mountains also impacts the number of frost-free days. While the valley locations can experience as many as 189 frost-free days (Tremonton), the upper elevations receive as few as 33 days (Hardware Ranch).[1]

The Bear River in the Uinta Mountains

AVERAGE ANNUAL WATER SUPPLY

Surface Water

Figure 3 shows schematically the annual flow of the Bear River throughout its length, as well as tributary inflows, diversions, and ground water inflows based on 1941-90 data.[2] The width of the bands representing the Bear River main stem and tributaries are proportional to the average annual

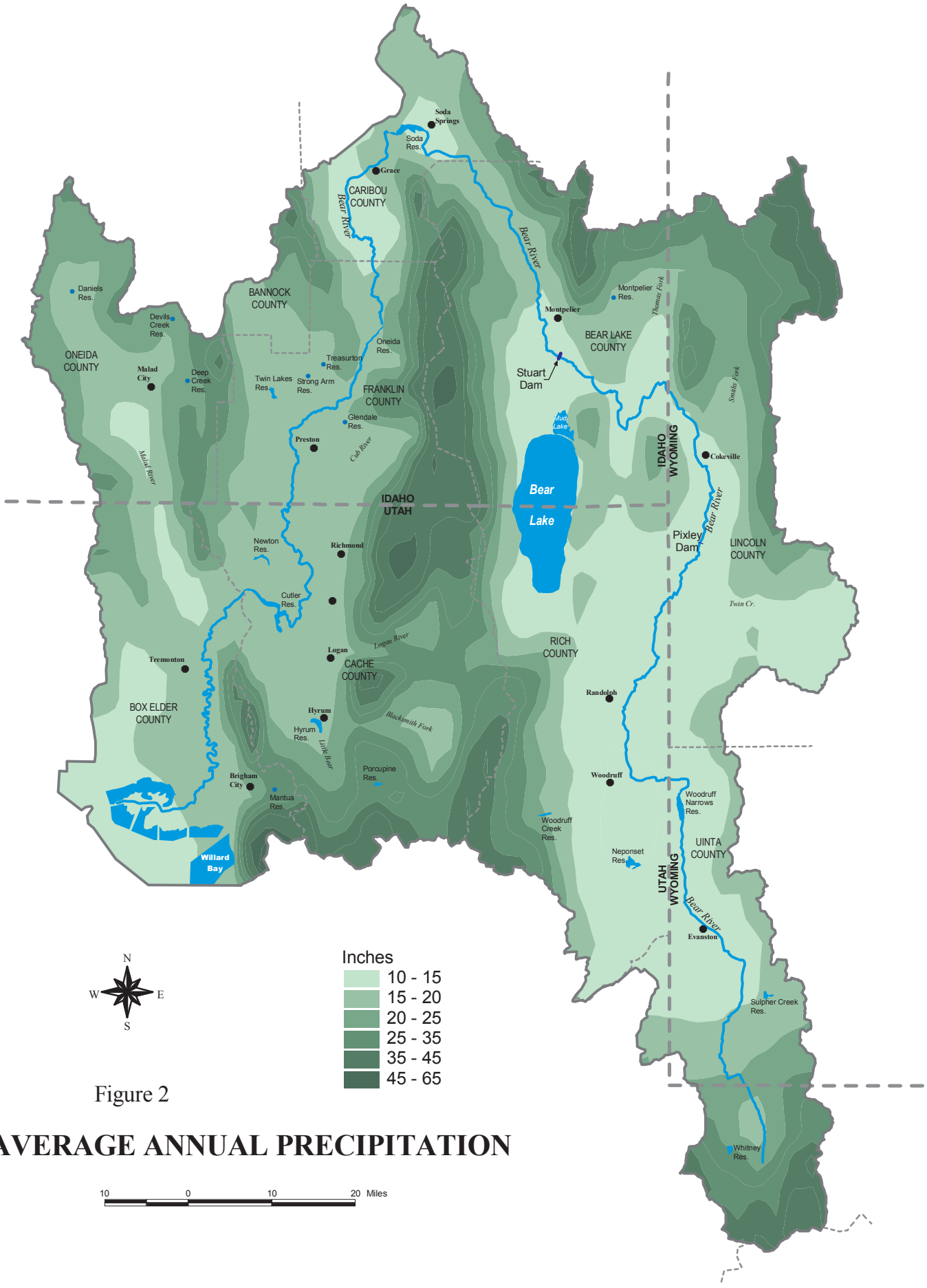


Figure 2

AVERAGE ANNUAL PRECIPITATION

TABLE 1
Climatological Data

Station	Temperature (Average Max and Min.)							Precipitation			Frost Free Days
	January		July		Mean Ann. (°F)	Record		Snow (in.)	Mean Ann. (in.)	Evap. Ave. Ann. (in.)	
	Max (°F)	Min. (°F)	Max. (°F)	Min. (°F)		Max. (°F)	Min. (°F)				
Box Elder Co.											
Cutler	29.4	13.6	89.1	61.1	49.3	107	-22	36.8	19.0	42.3	165
Plymouth	NR	NR	NR	NR	NR	NR	NR	26.2	9.8	48.8	NR
Tremonton	35.8	22.0	90.9	69.1	52.9	105	-11	24.4	17.9	40.6	189
Bothwell	NR	NR	NR	NR	NR	NR	NR	33.9	12.97	NR	NR
Corinne	33.5	14.4	90.5	56.9	48.7	110	-32	34.5	17.7	47.3	139
Brigham City	36.1	18.7	92.9	61.8	51.4	105	-16	63.9	19.3	46.0	162
Cache Co.											
Richmond	31.4	13.1	90.0	52.9	46.6	104	-28	69.4	19.5	45.3	121
Logan (KVNU)	30.8	11.3	89.3	54.4	46.4	104	-30	25.4	16.6	44.4	132
Logan (USU)	31.7	15.5	86.7	59.2	47.8	102	-25	68.7	19.5	40.9	158
Logan (Exp. St.)	33.5	14.7	88.7	54.4	47.4	99	-27	17.3	16.6	44.3	133
Logan (5 SW)	31.3	8.7	87.6	51.7	45.2	102	-44	50.9	18.2	43.7	118
Hardware Ranch	34.9	5.3	84.9	40.6	41.2	100	-43	64.9	17.4	44.2	33
Trenton	30.8	10.2	87.4	50.1	44.8	105	-44	52.0	17.7	44.8	112
Rich Co.											
Laketown	32.0	10.7	83.1	47.7	42.2	96	-37	42.5	12.2	40.5	85
Randolph	25.9	-0.2	80.6	43.2	38.4	92	-43	34.2	11.2	40.2	50
Woodruff	28.5	2.4	81.7	44.0	39.0	94	-47	42.3	9.0	40.0	56
Bear Lake	31.7	12.0	84.6	49.6	44.6	92	-25	41.1	14.0	42.0	109
Summit Co.											
Uintalands	32.7	6.6	73.9	41.8	37.0	85	-33	224	22.9	34.7	53

NR – no record
Source: *Utah Climate*, Utah Climate Center, USU (period of record: 1948-92)

flow in acre-feet. Main stem gaging stations are indicated by rectangles while diversions from the Bear River and from tributaries are represented by arrowheads. Bear Lake inflows and outflows are similarly shown. For most of the canals only the average annual depletion figure is shown. For these canals it is assumed that return flows occur reasonably close to the diversion. In some instances, however, such as the Twin Lakes Canal and the West Cache Canal, water is diverted upstream of the gage but the return flows are below the gage. In order to balance the figures from gage to gage it is necessary, at these locations, to show and use the actual diverted flows. Consequently, for some of the canals the average annual diversion figure is shown in parenthesis below the average annual depletion figure. Where both figures are shown the average annual diversion figure is the one that has been used to calculate streamflows.

The Logan River is the largest tributary to the Bear River. Blacksmith Fork and the Little Bear River join the Logan River before it enters Cutler Reservoir. The next largest tributary is Smiths Fork in Wyoming. Others are the Cub River and the Malad River in Idaho and Utah; Mink Creek and Soda Creek in Idaho. Major diversions are the Last Chance Canal in Idaho, West Cache Canal in Idaho, the Bear River Canal Company's West Side and East Side canals in Utah, and the Bear River Migratory Bird Refuge in Utah. A significant quantity of return flow and ground water flows to the river system in Cache and Box Elder counties.

Figure 3

BEAR RIVER FLOW CHART

TABLE 2
Stream Gage Records

Gaging Station On Bear River	Station Number	Drainage Area (square miles)	Period of Record	Instantaneous Extremes		Average Annual Runoff (1,000 acre-feet)	
				Min. (cfs)	Max. (cfs)	1941-90	Period of Record
Near Ut-Wy State line	10011500	172	1942-2002	7	3,230	140	142
Near Woodruff	10020300	784	1961-2002	0	3,820	163	173
Near Randolph	10026500	1,616	1943-1992	2	3,630	150	150
Smiths Fork, Wy[a]	10032000	165	1942-2002	21	2,100	142	140
At Wy-Id State Line	10039500	2,486	1937-1995	24	4,880	325	315
At Harer, Id.	10044000	2,839	1913-1986	26	5,140	393	393
Rainbow Inlet	10046000	-	1922-2002	0	4,950	304	272
Bear Lake Outlet	10059500	-	1922-2002	1	3,080	332	301
Pescadero	10068500	3,705	1921-2002[b]	23	4,280	466	444
Alexander	10079500	4,099	1911-2002	14	4,740	588	539
1Below Oneida Res.	10086000	4,456	1921-2002	3	5,480	681	623
At Id.-Ut. State line	10092700	4,881	1970-2002	48	4,870	746	834
Logan River[a]	10109000	214	1896-2002	50	2,000	156	182
Near Collinston	10118000	6,267	1889-2002	10	14	1,095	1,165
Near Corinne	10126000	7,029	1949-2002[b]	47	14	1,232	1,293

Source: USGS Water Resource Data[2] [a] tributary stream [b] not a continuous record

The Bear River modeling done in 1992 with 1941-1990 data is still an accurate representation of average conditions in the Bear River Basin. A comparison of the 1941-1990 stream-flow data with the current period of record data is included in Table 2. Dry years between 1991 and 1995 have reduced average annual flows at several locations, particularly the diversions to Bear Lake at the Rainbow inlet and the releases from Bear Lake. The flow at the Idaho/Utah state line was also adversely affected by the dry years, whereas average flows near Collinston and Corinne have remained relatively unchanged.

Bear River above Corinne in flood stage (circa 1983)

A summary of streamflow records for the Bear River is also shown in Table 2. The locations of gaging stations are shown in Figure 4. Except for the Rainbow Inlet Canal, the Bear Lake Outlet Canal, and the Logan River gages, all streamflow records in Table 2 are from mainstem gaging stations. They are listed in downstream order, beginning with the Bear River crossing of the Utah-Wyoming state line, and ending with the last gaging station on the river, near Corinne, before the river enters the Bear River Migratory Bird Refuge.

Available Water Supply

By combining the climatological data with the streamflow data, an accurate snapshot of the water supply within the Bear River Basin can be produced. Table 3 presents a water budget for the Utah portion of the basin. The average annual precipitation for the basin is 22 inches per year. Within the Utah portion of the basin (3,381 square miles) this produces roughly 4 million acre-feet of water. It is estimated that about 1,903,000 acre-feet (48 percent) of that is used by the native vegetation and natural systems. The remaining 2,097,000 acre-feet of basin yield manifests itself in surface and subsurface flow working its way toward the Great Salt Lake.

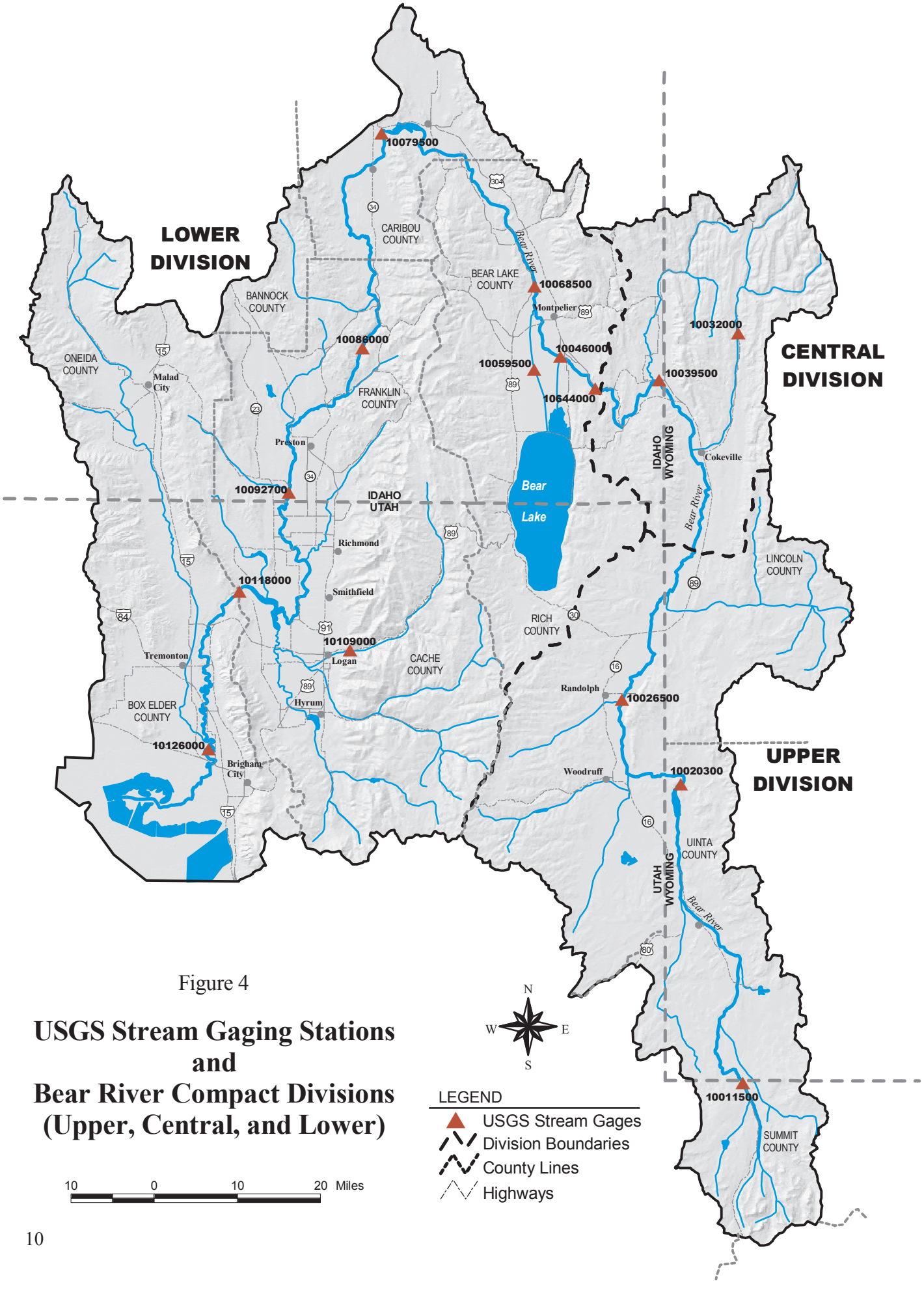


Figure 4

USGS Stream Gaging Stations and Bear River Compact Divisions (Upper, Central, and Lower)

TABLE 3
Estimated Water Budget
for the Utah Portion of the Bear River Basin

Category	Water Supply (acre-feet)
Total Precipitation	4,000,000
Used by vegetation and natural systems	1,903,000
Basin Yield	2,097,000
Agricultural Depletions	536,000
M&I Depletions	21,000
Wetland/Riparian Depletion & Reservoir Evaporation	340,000
Flow to Great Salt Lake	1,200,000

Source: *Utah Water Data Book* (1961-1990 average annual supply and present depletions) [3]

Agricultural water depletions (unrecoverable uses) are estimated to be 536,000 acre-feet. Municipal and industrial uses in the basin deplete roughly 21,000 acre-feet. It is estimated that the losses in the basin's wet and open water areas, including evaporative losses in the Bear River Migratory Bird Refuge, are 340,000 acre-feet. The estimated total annual average outflow into the Great Salt Lake from the Bear River is 1,200,000 acre-feet.

An average annual flow of 1,200,000 acre-feet from the Bear River into the Great Salt Lake can give the misleading impression that there actually are 1,200,000 acre-feet of water available for development. In reality, water rights held by the Bear River Migratory Bird Refuge account for a great deal of this water and necessitate that much of it continue to flow to the refuge. Additionally, the Bear River Compact designates how the developable waters of the river are to be allocated among Idaho, Utah, and Wyoming. Assuming full development by Idaho and Wyoming and taking into consideration current uses and existing water rights, there remains an average annual developable flow of about 250,000 acre-feet for Utah. The water that is available for development is winter and spring flow. Because of the natural variability of the river's annual flow, the development of a firm yield of 250,000 acre-feet will require new storage.

Logan River

To provide a dependable water supply of this undeveloped flow will require new storage approximately equal to the amount of water to be developed. There may be options to develop some of this water through the use of existing reservoirs, but ultimately the development of 250,000 acre-feet will require the construction of a new reservoir(s) and/or other water development options such as aquifer storage and recovery.

Ground Water

In 1994 the U.S. Geological Survey (USGS) published *Hydrology of Cache Valley, Cache County, Utah and Adjacent part of Idaho, with Emphasis on Simulation of Ground-Water Flow.*[4] The study showed a close regional hydrologic connection between ground water, springs and streams. This led the State Engineer's Office to adopt its Interim Cache Valley Ground-Water Management Plan in September 1999. The plan points out that much of the developable water in the basin is available only during winter and spring runoff. During peak demand periods of most years, principal water sources are fully appropriated and there is insufficient flow in surface sources to meet the demand of all existing surface water rights. Consequently, the plan limits the development of new ground water rights in order to maintain the reliability of existing surface water rights. The plan states, "The limiting factor regarding ground water development in Cache Valley is not the amount of water which is physically available within the aquifers, but rather the amount of ground water

which can be withdrawn without impairing prior rights."[6] New appropriations must show either no impact to existing water rights or a plan to compensate or mitigate the impacts to existing water rights. Ground water may also be developed by filing a change application on existing surface water rights.

Estimates of ground water recharge and discharge from the USGS ground water study are given in Table 4. Based upon the USGS ground water study and other available data the State Engineer's office, through its Interim Cache Valley Ground-Water Management Plan will allow an additional 25,000 acre-feet per year of ground water withdrawals in the Cache Valley. As this water is developed, the effect of such development on the hydrologic system will be evaluated to determine if additional withdrawals can be allowed.

TABLE 4

Cache Valley Ground Water Recharge and Discharge

Recharge	Acre-Feet
Infiltration of precipitation	90,000
Seepage from streams	1,000
Seepage from canals	86,000
Other forms of recharge (bedrock)	46,000
Total	223,000
Discharge	
Seepage to streams	70,000
Spring Discharge	58,000
Evapotranspiration	36,000
Seepage to Reservoirs	31,000
Withdrawals from wells	28,000
Total	223,000

Source: Interim Cache Valley Ground-Water Management Plan, State Engineer's Office.

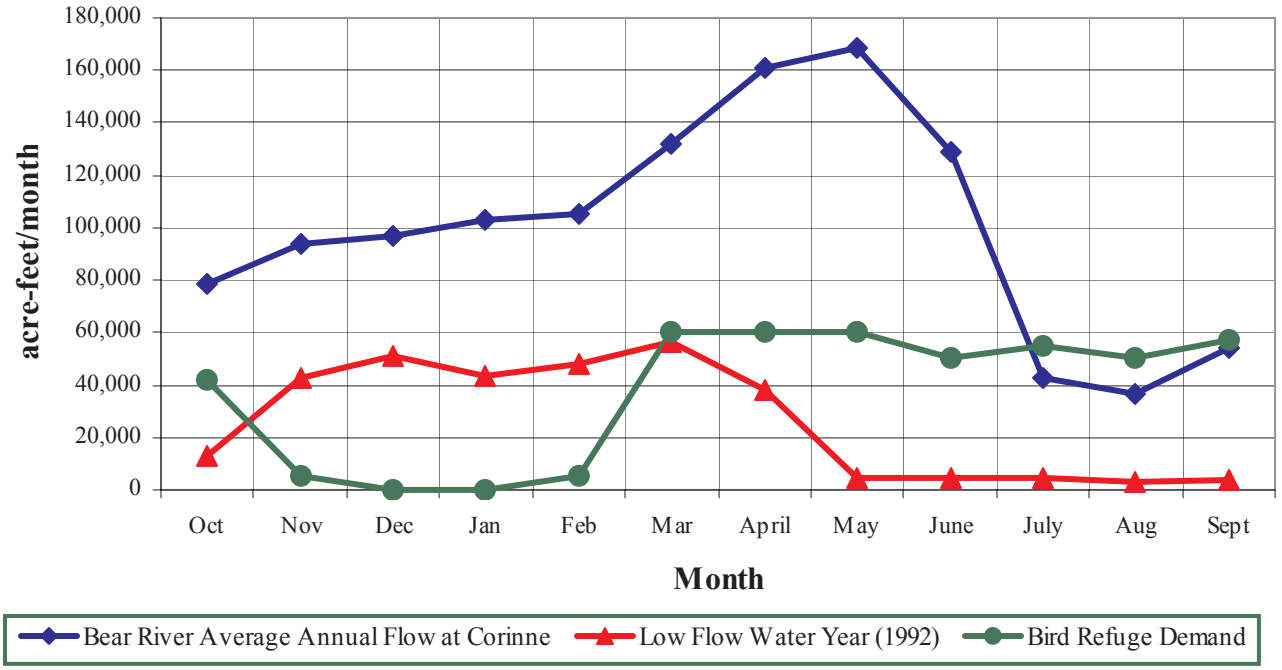
DEVELOPABLE SUPPLY

On an average annual basis, 1.2 million acre-feet of water flows past the Corinne gaging station and into the Bear River Migratory Bird Refuge. The 50-year interval of 1941-90 is a fairly representative base period for streamflow averages and other hydrologic computations. This period of record includes weather cycles with both extremely high and low water years. Assuming full development by Idaho and Wyoming, and taking into consideration current uses, the Bear River was modeled for this period of record (1941-90). The modeling reveals, that depending upon the amount of reservoir storage built, between 60,000 and 250,000 acre-feet of water can be developed in the state of Utah. Unfortunately, in dry years, there is very little developable flow and it is primarily limited to the winter flows and spring runoff. In wet years the developable flow can be significantly higher than the average annual flow. Consequently, the development of a firm yield will require the construction of reservoir storage. The relationship between the developable yield and the needed reservoir storage will be discussed in more detail in Chapter 6 Water Development.

Figure 5 compares the average annual flow of the Bear River at the Corinne gaging station (blue line) with the record low flow water year of 1992 (red line) and the demand for water at the Bear River Migratory Bird Refuge (green line). The average monthly flow at the Corinne gage rises from 80,000 acre-feet per month in October to just over 100,000 acre-feet per month in February. With the spring runoff, the flow at Corinne rises on average to 160,000 acre-feet per month in May. Through June the flow drops off dramatically to an average annual flow of about 40,000 acre-feet per month in July and August before increasing slightly in September. The lowest annual flow on record at the Corinne gage was the 1992 water year. Flows that year started at 13,000 acre-feet/month in October and then ranged between 40,000 and 60,000 acre-feet/month during the winter months of November through March, before dropping off significantly in April and settling below 5,000 acre-feet/month throughout the entire summer.

Below the Corinne gage the only significant water use is at the Bear River Migratory Bird Refuge. The bird refuge's water demand is also shown in Figure 5 and reflects the refuge's water right and desired delivery pattern. The bird refuge's water needs are fairly insignificant during the winter

Figure 5
Bear River Flows at Corinne vs Downstream Demand



months of November through February. From March through September the bird refuge's water needs hover around 60,000 acre-feet per month (1,000 cfs). As can be seen in Figure 5, the average annual flow of the river in July, August, and to some extent September, is inadequate to meet the needs of the refuge. During dry years, however, the flow of the river is inadequate to meet the bird refuge's need for more than half of the year.

The Bear River just north of the Bird Refuge

Recognizing the need to supplement the river's flow during the summer months, the U.S. Fish and Wildlife Service is currently working with the Bureau of Reclamation to explore the possibility of enlarging Hyrum Reservoir to meet summer needs at the Bear River Bird Refuge. Surplus runoff in the spring months would be stored in Hyrum Reservoir and released in the late summer months to increase the refuge's late summer water supply and help mitigate against the possible outbreak of botulism and other ill effects the refuge suffers as a result of low flows. The possibility of enlarging Hyrum Reservoir will be discussed in more detail in Chapter 6, Water Development.

The developable flow of the Bear River is represented, in Figure 5, by the area between the blue line (flow at Corinne) and the green line (demand at the Migratory Bird Refuge). During dry years the developable flow is considerably less and is represented as the area between the red line (record low flow) and the green line. But even

during the driest year on record the Bear River has water available for development from November through February if storage is available. However, the need for storage is attested to by the lack of late summer flows and the significant reduction in the volume of flow in dry years.

TABLE 5
Bear River Development Act Allocations
(acre-feet)

Bear River Water Conservancy District	60,000
Jordan Valley Water Conservancy District	50,000
Weber Basin Water Conservancy District	50,000
Cache County	60,000
Total	220,000

Source: Bear River Development Act – 1991

In 1991 the Utah State Legislature passed the Bear River Development Act. The act directs the Utah Division of Water Resources to develop 220,000 acre-feet of Bear River water and allocates that water as shown in Table 5. The approach currently being considered is to: 1) modify the existing operation of Willard Bay by agreement with the Weber Basin Water Conservancy District; 2) connect the Bear River with a pipeline and/or canal to Willard Bay from a point near the Interstate 15 crossing of the Bear River near Elwood in Box Elder County; 3) construct conveyance and treatment facilities to deliver water from Willard Bay to the Wasatch Front; and 4) build a dam in the Bear River Basin as the demand for additional water continues to increase..

More than likely, the construction of a dam in the Bear River Basin will ultimately hinge on the needs of the basin's residents to develop their own allocated portion of the Bear River. The Bear River Water Conservancy District and the Cache County water users have allocations of 60,000 acre-feet each. Some of that water could possibly be developed without additional storage. However, the development of a firm yield, particularly during periods of drought when new water sources will most likely be needed, will require some form of storage.

Water Rights

The State Engineer (Utah Division of Water Rights) is presently adjudicating water rights in Box Elder County to define surface and ground water rights that are held for various uses under decrees, claims, and applications. Proposed Determinations have been completed for Cache and Rich counties. Several applications to develop large additional amounts of water have been filed in the lower basin. Any water development on the Bear River or its tributaries must conform to established water rights as well as the Bear River Compact. Table 6 lists each of the water rights areas and sub-areas within the basin along with a statement of the current status and general policy.

The Dietrich Decree was filed on July 14, 1920, in District Court of the United States for Idaho, eastern Division. The decree quantified and prioritized water rights for irrigation and power on the Bear River in Idaho. It also granted Utah Power and Light (now PacifiCorp) the right to divert 5,500 cfs of Bear River water into Bear Lake and 500 cfs from the Bear Lake and Mud-Lake tributaries. Non-consumptive rights were also granted for power purposes at the downstream hydropower projects.

On February 21, 1922, the Kimball Decree was filed in Utah District Court in Cache County. The Kimball Decree quantified and prioritized water rights on the Bear River in Utah. It also recognized Utah Power and Light's right to divert Bear River Water and store it in Bear Lake as well as non-consumptive rights for power purposes.

Bear River Compact

In 1958 the Bear River Compact was ratified by Congress and signed by the President of the United States. The compact provided for: (1) apportionment of Bear River flows between the states of Utah, Wyoming and Idaho; (2) allocation of upstream storage above Bear Lake; (3) establishment of an irrigation reserve in Bear Lake and; (4) a review of the compact provisions every 20 years.

TABLE 6
GENERAL STATUS OF WATER RIGHTS
BEAR RIVER BASIN

AREA	SUBAREA	STATUS AND GENERAL POLICY
21	Summit County	Status: Revised Proposed Determination published in 1962. Policy: Only domestic filings for in-house use are approved.
23	Laketown	Status: Proposed Determination published in 1965. Policy: Canyon areas are fully appropriated. Springs and streams are closed to new appropriations of both ground water and surface water.
	Southeast	Status: Proposed Determination published in 1966. Policy: Canyon areas are fully appropriated. Springs and streams are closed to new appropriations of both ground water and surface water.
	Woodruff Creek	Status: Proposed Determination published in 1966. Policy: Canyon areas are fully appropriated. Springs and streams are closed to new appropriations of both ground water and surface water.
	Northeast	Status: Proposed Determination published in 1965. Policy: Canyon areas are fully appropriated. Springs and streams are closed to new appropriations of both ground water and surface water.
	Big Creek, Randolph Creek & Otter Creek	Status: Proposed Determination published in 1966. Policy: Canyon areas are fully appropriated. Springs and streams are closed to new appropriations of both ground water and surface water.
25	Logan River	Status: Proposed Determinations published in 1974 & 1976. (3 books) Policy: Canyon areas closed. For most areas ground water is open to single family domestic applications. All applications are subject to the Cache Valley Ground water Management Plan implemented Sept. 1, 1999.
	Richmond (High Creek)	Status: Proposed Determination published in 1977. Policy: Canyon areas closed. For most areas ground water is open to single family domestic applications. All applications are subject to the Cache Valley Ground water Management Plan implemented Sept. 1, 1999. The Cove Area is closed to all but domestic application.
	Lewiston, Clarkston, & Newton	Status: Proposed Determination published in September 15, 1979. Policy: Canyon areas closed. For most areas ground water is open to single family domestic applications. All applications are subject to the Cache Valley Ground water Management Plan implemented Sept. 1, 1999.
	Blacksmith Fork	Status: Proposed Determination published in October 1, 1967. Policy: Canyon areas closed. For most areas ground water is open to single family domestic applications. All applications are subject to the Cache Valley Ground water Management Plan implemented Sept. 1, 1999.
	South Fork & East Fork	Status: Proposed Determination published in 1953. Policy: Canyon areas closed. For most areas ground water is open to single family domestic applications. All applications are subject to the Cache Valley Ground water Management Plan implemented Sept. 1, 1999.
29	Brigham City & Deweyville	Status: Proposed Determination published in October 1, 1990. Policy: Areas tributary to Black Slough are closed. All appropriations except .015's* are subject to the revised Bear River Compact.
	Willard	Status: Proposed Determination published on August 24, 1960. Policy: Area closed if springs lie down gradient. All appropriations except .015's* are subject to the Amended Bear River Compact.
	Portage Creek	Status: Proposed Determination published in September 5, 1991. Policy: All appropriations except .015's* are subject to the revised Bear River Compact.
	Thatcher Penrose	Status: Proposed Determination published on August 24, 1960. Policy: All appropriations except .015's* are subject to the revised Bear River Compact.
	Plymouth	Status: Proposed Determination published on August 24, 1960. Policy: All appropriations except .015's* are subject to the revised Bear River Compact.

* This is a single-family residential water right of .015 cubic feet per second.

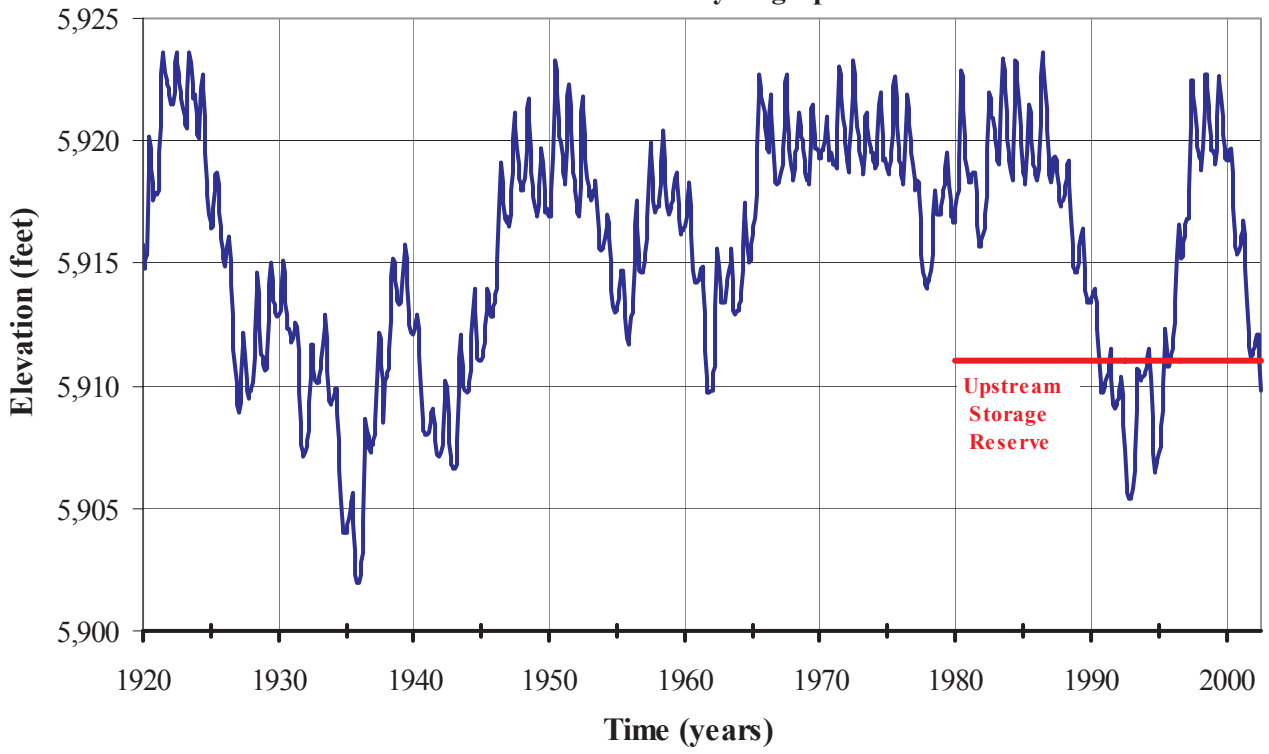
In 1980 the Bear River Compact was amended[7] to allow additional storage above Bear Lake. It also set restrictions on the additional upstream storage when the elevation of Bear Lake was below elevation 5911. The Bear River Compact also established criteria for adjusting the irrigation reserve as upstream storage increased. Prior to the Operational Agreement for PacifiCorp's Bear River System, signed in 2000, the irrigation reserve elevation was the management tool use to regulate non-irrigation releases from the lake. When the elevation of Bear Lake was below the irrigation reserve no water could be released from the lake solely for purpose of generating power. Currently, the lake is managed using a target elevation. A more detailed explanation of the current method of managing the lake will follow.

In 1994 Cutler Reservoir was relicensed by FERC for continued use as a hydropower facility. The relicensing process for Soda, Cove and Oneida hydropower plants is currently underway and scheduled for completion in 2003.

In 1995 the Bear Lake Group, a consortium of landowners, recreational and environmental interest groups filed a lawsuit against the U.S. Army Corps of Engineers and the Environmental Protection Agency. This lawsuit challenged the issuance of permits allowing PacifiCorp to dredge the channel to the Lifton pump station. In April of 1995, a Bear Lake Settlement Agreement was signed by the interested parties, the Last Chance Canal Company, the West Cache Canal Company, the Bear River Canal Company, the Idaho Pumpers Association, Bear Lake Watch, Emerald Beach, Bear Lake East and PacifiCorp. As part of the Settlement Agreement, PacifiCorp agreed not to dredge in 1995 and the Bear Lake land owners and special interest groups agreed to drop the pending law suit. All parties agreed to form a new Bear Lake Preservation Advisory Committee that would meet annually in an attempt to negotiate resolutions to disagreements between the parties that would otherwise result in litigation.

In April 2000, PacifiCorp signed an operational agreement with the states of Utah, Idaho and Wyoming to continue operating Bear Lake as it has been done historically. Water will be released from

Figure 6
Historic Bear Lake Hydrograph



Bear Lake only for flood control and to meet downstream irrigation contractual requirements. Once water is released for irrigation or flood control, power can be generated at the various downstream hydropower plants as a secondary benefit. Bear Lake will now be managed by use of a target elevation rather than an irrigation reserve. PacifiCorp's Target Elevation (PTE) will be set on March 31 of each year. The PTE may range from as low as 5916 feet during high runoff conditions to 5920 feet during projected low runoff conditions. Under normal conditions the PTE will be set at 5918. Generally, if Bear Lake's elevation is higher than the PTE at the end of the irrigation season, releases are scheduled to lower Bear Lake to the PTE by March 31 of the following year. Conversely, if Bear Lake is below the PTE at the end of the irrigation season, releases are curtailed until such time as the lake is predicted to reach the PTE or until such time as high snowpack and runoff forecasts during the following winter months require PacifiCorp to make releases for flood control.

NOTES

1. *Utah Climate*, Gaylen L. Ashcroft, Donald T. Jensen, Jeffrey L. Brown, (by Utah Climate Center, 1992).
2. *The Water Resources Data Utah*, Water Year 1990, U.S. Geological Survey Water Data Report UT-90-1
3. *The Utah Water Data Book*, Division of Water Resources, August 1997.
4. *Hydrology of Cache Valley, Cache County, Utah and Adjacent parts of Idaho, with Emphasis on Simulation of Ground-Water Flow*,
5. Bjorklund, L.J. and McGreevy, L.J., 1971, *Ground-water resources of Cache Valley, Utah and Idaho*: Utah Department of Natural Resources Technical Publication No. 36.
6. *Interim Cache Valley Ground-Water Management Plan*, Utah Division of Water Rights, p2
7. *Bear River Compact As Amended and By Laws of Bear River Commission*, December 22, 1978.